AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Original) A self-lubricating expansion mandrel for expanding a tubular member, comprising:

a housing that defines a lubrication supply chamber including a tapered outer surface;

a supply of a lubricant material within the lubrication supply chamber;

one or more grooves formed in the tapered outer surface;

solid lubricant retained in one or more of the grooves; and

means for forcing the lubricant material from the lubrication supply chamber to one or more of the grooves.

2. (Original) The self-lubricating expansion mandrel of claim 1, wherein the grooves comprise circumferential grooves.

3. (Original) The self-lubricating expansion mandrel of claim 1, wherein the grooves comprise axial grooves.

4. (Original) The self-lubricating expansion mandrel of claim 1, wherein the grooves comprise a pattern of grooves with both an axial and a circumferential component.

5. (Original) The self-lubricating expansion mandrel of claim 4, wherein the pattern of grooves comprises a textured surface.

6. (Original) The self-lubricating expansion mandrel of claim 1, wherein the solid lubricant retained in one or more of the grooves comprises a self-lubricating film.

7. (Original) The self-lubricating expansion mandrel of claim 6, wherein the depth of the grooves is in a range of between about 1 and 4 microns.

8. (Original) The self-lubricating expansion mandrel of claim I, wherein the solid lubricant retained in one or more of the grooves comprises a fluoropolymer coating.

9. (Original) The self-lubricating expansion mandrel of claim 8, wherein the depth of the grooves is in a range of between about 10 and 50 microns.

10. (Original) The self-lubricating expansion mandrel of claim 1, wherein the solid lubricant retained in one or more of the grooves comprises a thermo-sprayed coating.

11. (Original) The self-lubricating expansion mandrel of claim 10, wherein the depth of the grooves is in a range of between about 50 and 150 microns.

12. (Original) A self-lubricating expansion mandrel for expanding a tubular member, comprising:

a housing that defines a lubricant supply chamber including a tapered outer surface;

a quantity of a lubricant material within the lubricant supply chamber;

a textured pattern formed in the tapered outer surface;

solid lubricant retained in a plurality of troughs formed in the textured pattern; and

means for forcing the lubricant material from the lubrication supply chamber to one or more of the troughs.

13. (Original) The self-lubricating expansion mandrel of claim 12, wherein the solid lubricant retained in the plurality of troughs formed in a textured pattern comprises a self-lubricating film.

14. (Original) The self-lubricating expansion mandrel of claim 13, wherein the depth of the plurality of troughs formed in a textured pattern is in a range of between about 1 and 4 microns.

15. (Original) The self-lubricating expansion mandrel of claim 12, wherein the solid lubricant retained in the plurality of troughs formed in a textured pattern comprises a fluoropolymer coating.

16. (Original) The self-lubricating expansion mandrel of claim 15, wherein the depth of the plurality of troughs formed in a textured pattern is in a range of between about 10 and 50 microns.

17. (Original) The self-lubricating expansion mandrel of claim 12, wherein the solid lubricant retained in the plurality of troughs formed in a textured pattern comprises a thermo-sprayed coating.

18. (Original) The self-lubricating expansion mandrel of claim 12, wherein the depth of the plurality of troughs formed in a textured pattern is in a range of between about 50 and 150 microns.

19. (Original) A self-lubricating expansion mandrel for expanding a tubular member, comprising:

a housing including a tapered outer surface;

one or more grooves formed in the taped outer surface; and

a grease supply chamber in the housing;

a conduit from the grease supply chamber to one or more of the grooves; and

means for forcing grease from the grease supply chamber trough the conduit to one or more of the grooves.

20. (Original) The self-lubricating expansion mandrel of claim 19, wherein the one or more grooves comprise circumferential grooves.

21. (Original) The self-lubricating expansion mandrel of claim 19, wherein the grooves comprise axial grooves.

22. (Original) The self-lubricating expansion mandrel of claim 19, wherein the grooves comprise a pattern of grooves with both an axial and a circumferential component.

23. (Original) The self-lubricating expansion mandrel of claim 22, wherein the pattern of grooves comprises a textured surface.

24. (Original) A self-lubricating expansion mandrel for expanding a tubular member, comprising:

a housing defining a lubricant supply chamber including a tapered outer surface;

one or more grooves formed in the tapered outer surface;

a quantity of a lubricant material within the lubricant supply chamber;

solid lubricant retained in one or more of the grooves; and

means for forcing the lubricant material from the lubricant supply chamber to one or more of the grooves;

wherein the grooves comprise circumferential grooves.

25. (Original) A self-lubricating expansion mandrel for expanding a tubular member, comprising:

a housing defining a lubricant supply chamber including a tapered outer surface;

one or more grooves formed in the tapered outer surface;

a quantity of a lubricant material within the lubricant supply chamber;

solid lubricant retained in one or more of the grooves; and

means for forcing the lubricant material from the lubricant supply to one or more of the grooves;

wherein the grooves comprise axial grooves.

26. (Original) A self-lubricating expansion mandrel for expanding a tubular member, comprising:

a housing defining a lubricant supply chamber including a tapered outer surface;

one or more grooves formed in the tapered outer surface;

a quantity of a lubrication material within the lubricant supply chamber;

solid lubricant retained in one or more of the grooves; and

means for forcing the lubrication material from the lubricant supply chamber to one or more of the grooves;

wherein the grooves comprise a pattern of grooves with both an axial and a circumferential component.

27. (Original) A self-lubricating expansion mandrel for expanding a tubular member, comprising:

a housing that defines a lubricant supply chamber including a tapered outer surface;

a quantity of a lubricating material within the lubricant supply chamber;

a pattern of grooves formed in the tapered outer surface;

solid lubricant retained in the pattern of grooves; and

means for forcing the lubricating material from the lubricant supply chamber to one or more of the pattern of grooves;

wherein the pattern of grooves comprises a textured surface.

28. (Original) A self-lubricating expansion mandrel for expanding a tubular member, comprising:

a housing that defines a lubricant supply chamber including a tapered outer surface;

a quantity of a lubricating material within the lubricant supply chamber;

one or more grooves formed in the tapered outer surface;

solid lubricant retained in one or more of the grooves; and

means for forcing the lubricating material from the lubricant supply chamber to one or more of the grooves;

wherein the depth of the grooves is in a range of between about 1 and 4 microns.

29. (Original) A self-lubricating expansion mandrel for expanding a tubular member, comprising:

a housing that defines a lubricant supply chamber including a tapered outer surface;

a quantity of a lubrication material within the lubricant supply chamber;

one or more grooves formed in the tapered outer surface;

solid lubricant retained in one or more of the grooves; and

means for forcing the lubrication material from the lubricant supply chamber to one or more of the grooves;

wherein the depth of the grooves is in a range of between about 10 and 50 microns.

30. (Original) A self-lubricating expansion mandrel for expanding a tubular member, comprising:

a housing that defines a lubricant supply chamber including a tapered outer surface;

a quantity of a lubrication material within the lubricant supply chamber;

one or more grooves formed in the tapered outer surface;

solid lubricant retained in one or more of the grooves; and

means for forcing the lubrication material from the lubricant supply chamber to one or more of the grooves;

wherein the solid lubricant retained in one or more of the grooves comprises a thermo-sprayed coating.

31. (Original) A self-lubricating expansion mandrel for expanding a tubular member, comprising:

a housing that defines a lubricant supply chamber including a tapered outer surface;

a quantity of a lubrication material within the lubricant supply chamber;

one or more grooves formed in the tapered outer surface;

solid lubricant retained in one or more of the grooves; and

means for forcing the lubricating material from the lubricant supply chamber to one or more of the grooves;

wherein the depth of the grooves is in a range of between about 50 and 150 microns.

32. (Original) A self-lubricating expansion device for expanding a tubular member, comprising:

a housing including a tapered outer surface;

one or more depressions formed in the tapered outer surface; and

a lubricant supply chamber defined in the housing;

a conduit from the lubricant supply chamber to one or more of the depressions; and

means for forcing lubricant from the lubricant supply chamber through the conduit to one or more of the depressions.

33. (Original) The self-lubricating expansion mandrel of claim 32, wherein the one or more depressions comprise circumferential grooves.

34. (Original) The self-lubricating expansion mandrel of claim 32, wherein the depressions comprise axial grooves.

35. (Original) The self-lubricating expansion mandrel of claim 32, wherein the depressions comprise a pattern of grooves with both an axial and a circumferential component.

36. (Original) The self-lubricating expansion mandrel of claim 35, wherein the pattern of grooves comprises a textured surface.

37. (Original) A self-lubricating expansion device for expanding a tubular member, wherein the interface between the expansion device and the tubular member, during the expansion process, includes a leading edge portion and a trailing edge portion, comprising:

a housing including a tapered outer surface;

one or more first depressions formed in the leading edge portion of the tapered outer surface; and

a lubricant supply chamber in the housing;

a conduit from the lubricant supply chamber to one or more of the first depressions;

means for forcing lubricant from the lubricant supply chamber trough the conduit to one or more of the depressions;

one or more second depressions formed in the trailing edge portion of the tapered outer surface; and

a solid lubricant provided within one or more of the second depressions.

38. (Original) The self-lubricating expansion mandrel of claim 37, wherein one or more of the first and second depressions comprise circumferential grooves.

39. (Original) The self-lubricating expansion mandrel of claim 37, wherein one or more of the first and second depressions comprise axial grooves.

40. (Original) The self-lubricating expansion mandrel of claim 37, wherein one or more of the first and second depressions comprise a pattern of grooves with both an axial and a circumferential component.

41. (Original) The self-lubricating expansion mandrel of claim 40, wherein the pattern of grooves comprises a textured surface.

42. (Original) A method of lubricating the interface between and expansion device and a tubular member during an expansion of the tubular member using the expansion device, wherein the interface between the expansion device and the tubular member comprises a leading edge portion and a trailing edge portion, comprising:

injecting a fluid lubricant into the leading edge portion; and

providing a solid lubricant in the trailing edge portion.

43. (Original) A system for lubricating the interface between and expansion device and a tubular member during an expansion of the tubular member using the expansion device, wherein the interface between the expansion device and the tubular member comprises a leading edge portion and a trailing edge portion, comprising:

means for injecting a fluid lubricant into the leading edge portion; and

means for providing a solid lubricant in the trailing edge portion.

44. (Original) A method of lubricating the interface between and expansion device and a tubular member during an expansion of the tubular member using the expansion device, wherein the interface between the expansion device and the tubular member comprises a leading edge portion and a trailing edge portion, comprising:

providing a supply of a fluid lubricant within the expansion device; and

injecting the fluid lubricant into the leading edge portion.

45. (Original) A system for lubricating the interface between and expansion device and a tubular member during an expansion of the tubular member using the expansion device, wherein the interface between the expansion device and the tubular member comprises a leading edge portion and a trailing edge portion, comprising:

means for providing a supply of a fluid lubricant within the expansion device; and

means for injecting the fluid lubricant into the leading edge portion.

46. (Original) A method of lubricating the interface between and expansion device and a tubular member during an expansion of the tubular member using the expansion device, wherein the interface between the expansion device and the tubular member comprises a leading edge portion and a trailing edge portion, comprising:

providing a supply of a solid lubricant on the expansion device within the trailing edge portion.

47. (Original) A system for lubricating the interface between and expansion device and a tubular member during an expansion of the tubular member using the expansion device, wherein the interface between the expansion device and the tubular member comprises a leading edge portion and a trailing edge portion, comprising:

means for providing a supply of a solid lubricant on the expansion device within the trailing edge portion.

48. (Withdrawn) A method for manufacturing an expandable member used to complete a structure by radially expanding and plastically deforming the expandable member comprising:

forming the expandable member from a steel alloy comprising a charpy energy of at least about 90 ft-lbs.

49. (Withdrawn) An expandable member for use in completing a structure by radially expanding and plastically deforming the expandable member, comprising:

a steel alloy comprising a charpy energy of at least about 90 ft-lbs.

50. (Withdrawn) A structural completion positioned within a structure, comprising:

one or more radially expanded and plastically deformed expandable members positioned within the structure;

wherein one or more of the radially expanded and plastically deformed expandable members are fabricated from a steel alloy comprising a charpy energy of at least about 90 ft-lbs.

51. (Withdrawn) A method for manufacturing an expandable member used to complete a structure by radially expanding and plastically deforming the expandable member, comprising:

forming the expandable member from a steel alloy comprising a weight percentage of carbon of less than about 0.08%.

52. (Withdrawn) An expandable member for use in completing a wellbore by radially expanding and plastically deforming the expandable member at a downhole location in the wellbore, comprising:

a steel alloy comprising a weight percentage of carbon of less than about 0.08%.

53. (Withdrawn) A structural completion, comprising:

one or more radially expanded and plastically deformed expandable members positioned within the wellbore;

wherein one or more of the radially expanded and plastically deformed expandable members are fabricated from a steel alloy comprising a weight percentage of carbon of less than about 0.08%.

54. (Withdrawn) A method for manufacturing an expandable member used to complete a structure by radially expanding and plastically deforming the expandable member, comprising:

forming the expandable member from a steel alloy comprising a weight percentage of carbon of less than about 0.20% and a charpy V-notch impact toughness of at least about 6 joules.

55. (Withdrawn) An expandable member for use in completing a structure by radially expanding and plastically deforming the expandable member, comprising:

a steel alloy comprising a weight percentage of carbon of less than about 0.20% and a charpy V-notch impact toughness of at least about 6 joules.

56. (Withdrawn) A structural completion, comprising:

one or more radially expanded and plastically deformed expandable members;

wherein one or more of the radially expanded and plastically deformed expandable members are fabricated from a steel alloy comprising a weight percentage of carbon of less than about 0.20% and a charpy V-notch impact toughness of at least about 6 joules.

57. (Withdrawn) A method for manufacturing an expandable member used to complete a structure by radially expanding and plastically deforming the expandable member, comprising:

forming the expandable member from a steel alloy comprising the following ranges of weight percentages:

C, from about 0.002 to about 0.08;

Si, from about 0.009 to about 0.30;

Mn, from about 0.10 to about 1.92;

P, from about 0.004 to about 0.07;

S, from about 0.0008 to about 0.006;

Al, up to about 0.04;

N, up to about 0.01;

Cu, up to about 0.3;

Cr, up to about 0.5;

Ni, up to about 18;

Nb, up to about 0.12;

Ti, up to about 0.6;

Co, up to about 9; and

Mo, up to about 5.

58. (Withdrawn) An expandable member for use in completing a structure by radially expanding and plastically deforming the expandable member, comprising:

a steel alloy comprising the following ranges of weight percentages:

C, from about 0.002 to about 0.08;

Si, from about 0.009 to about 0.30;

Mn, from about 0.10 to about 1.92;

P, from about 0.004 to about 0.07;

S, from about 0.0008 to about 0.006;

Al. up to about 0.04;

N, up to about 0.01;

Cu, up to about 0.3;

Cr, up to about 0.5;

Ni, up to about 18;

Nb, up to about 0.12;

Ti, up to about 0.6;

Co, up to about 9; and

Mo, up to about 5.

59. (Withdrawn) A structural completion, comprising:

one or more radially expanded and plastically deformed expandable members;

wherein one or more of the radially expanded and plastically deformed expandable members are fabricated from a steel alloy comprising the following ranges of weight percentages:

C, from about 0.002 to about 0.08;

Si, from about 0.009 to about 0.30;

Mn, from about 0.10 to about 1.92;

P, from about 0.004 to about 0.07;

S, from about 0.0008 to about 0.006;

Al, up to about 0.04;

N, up to about 0.01;

Cu, up to about 0.3;

Cr, up to about 0.5;

Ni, up to about 18;

Nb, up to about 0.12;

Ti. up to about 0.6;

Go, up to about 9; and

Mo, up to about 5.

60. (Withdrawn) A method for manufacturing an expandable tubular member used to complete a structure by radially expanding and plastically deforming the expandable member, comprising:

forming the expandable tubular member with a ratio of the of an outside diameter of the expandable tubular member to a wall thickness of the expandable tubular member ranging from about 12 to 22.

61. (Withdrawn) An expandable member for use in completing a structure by radially expanding and plastically deforming the expandable member, comprising:

an expandable tubular member with a ratio of the of an outside diameter of the expandable tubular member to a wall thickness of the expandable tubular member ranging from about 12 to 22.

62. (Withdrawn) A structural completion, comprising:

one or more radially expanded and plastically deformed expandable members positioned within the structure;

wherein one or more of the radially expanded and plastically deformed expandable members are fabricated from an expandable tubular member with a ratio of the of an outside diameter of the expandable tubular member to a wall thickness of the expandable tubular member ranging from about 12 to 22.

63. (Withdrawn) A method of constructing a structure, comprising:

radially expanding and plastically deforming an expandable member;

wherein an outer portion of the wall thickness of the radially expanded and plastically deformed expandable member comprises tensile residual stresses.

64. (Withdrawn) A structural completion, comprising:

one or more radially expanded and plastically deformed expandable members;

wherein an outer portion of the wall thickness of one or more of the radially expanded and plastically deformed expandable member comprises tensile residual stresses.

65. (Withdrawn) A method of constructing a structure using an expandable tubular member, comprising:

strain aging the expandable member; and

then radially expanding and plastically deforming the expandable member.

66. (Withdrawn) A method for manufacturing a tubular member used to complete a wellbore by radially expanding the tubular member at a downhole location in the wellbore comprising: forming a steel alloy comprising a concentration of carbon between approximately 0.002% and 0.08% by weight of the steel alloy.

67. (Withdrawn) The method of claim 66, further comprising forming the steel alloy with a concentration of niobium comprising between approximately 0.015% and 0.12% by weight of the steel alloy.

68. (Withdrawn) The method of claim 66, further comprising: forming the steel alloy with low concentrations of niobium and titanium; and limiting the total concentration of niobium and titanium to less than approximately 0.6% by weight of the steel alloy.

69. (Withdrawn) An expandable tubular member fabricated from a steel alloy having a concentration of carbon between approximately 0.002% and 0.08% by weight of the steel alloy.

70. (Withdrawn) A method for manufacturing an expandable tubular member used to complete a wellbore completion within a wellbore that traverses a subterranean formation by radially expanding and plastically deforming the expandable tubular member within the wellbore, comprising:

forming the expandable tubular member from a steel alloy comprising a charpy energy of at least about 90 ft-lbs;

forming the expandable member from a steel alloy comprising a charpy V-notch impact toughness of at least about 6 joules;

forming the expandable member from a steel alloy comprising the following ranges of weight percentages:

C, from about 0.002 to about 0.08;

Si, from about 0.009 to about 0.30;

Mn, from about 0.10 to about 1.92;

P, from about 0.004 to about 0.07;

S, from about 0.0008 to about 0.006;

Al, up to about 0.04;

N, up to about 0.01;

Cu, up to about 0.3;

Cr. up to about 0.5;

Ni, up to about 18;

Nb, up to about 0.12;

Ti, up to about 0.6;

Co, up to about 9; and

Mo, up to about 5;

forming the expandable tubular member with a ratio of the of an outside diameter of the expandable tubular member to a wall thickness of the expandable tubular member ranging from about 12 to 22; and

strain aging the expandable tubular member prior to the radial expansion and plastic deformation of the expandable tubular member within the wellbore.

71. (Withdrawn) An expandable tubular member for use in completing a wellbore completion within a wellbore that traverses a subterranean formation by radially expanding and plastically deforming the expandable tubular member within the wellbore, comprising:

a steel alloy having a charpy energy of at least about 90 ft-lbs;

a steel alloy having a charpy V-notch impact toughness of at least about 6 joules; and

a steel alloy comprising the following ranges of weight percentages:

C, from about 0.002 to about 0.08;

Si, from about 0.009 to about 0.30;

Mn, from about 0.10 to about 1.92;

P, from about 0.004 to about 0.07;

S, from about 0.0008 to about 0.006;

Al. up to about 0.04;

N, up to about 0.01;

Cu, up to about 0.3;

Cr, up to about 0.5;

Ni, up to about 18;

Nb, up to about 0.12;

Ti, up to about 0.6;

Co, up to about 9; and

Mo, up to about 5;

wherein a ratio of the of an outside diameter of the expandable tubular member to a wall thickness of the expandable tubular member ranging from about 12 to 22; and

wherein the expandable tubular member is strain aged prior to the radial expansion and plastic deformation of the expandable tubular member within the wellbore.

72. (Withdrawn) A wellbore completion positioned within a wellbore that traverses a subterranean formation, comprising:

one or more radially expanded and plastically deformed expandable tubular members positioned within the wellbore completion;

wherein one or more of the radially expanded and plastically deformed expandable tubular members are fabricated from:

a steel alloy comprising a charpy energy of at least about 90 fl-lbs;

a steel alloy comprising a charpy V-notch impact toughness of at least about 6 joules; and

a steel alloy comprising the following ranges of weight percentages:

C, from about 0.002 to about 0.08;

Si, from about 0.009 to about 0.30;

Mn, from about 0.10 to about 1.92;

P, from about 0.004 to about 0.07;

S, from about 0.0008 to about 07006;

Al. up to about 0.04;

N, up to about 0.01;

Cu, up to about 0.3;

Cr, up to about 0.5;

Ni, up to about 18;

Nb, up to about 0.12;

Ti, up to about 0.6;

Co, up to about 9; and

Mo, up to about 5;

wherein at least one of the expandable members comprises a ratio of the of an outside diameter of the expandable member to a wall thickness of the expandable member ranging from about 12 to 22;

wherein an outer portion of the wall thickness of at least one of the radially expanded and plastically deformed expandable comprises tensile residual stresses; and

wherein at least one of the expandable tubular member is strain aged prior to the radial expansion and plastic deformation of the expandable tubular member within the wellbore.